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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :

A01N 65/00, A61K 35/78, A61L 15/34

A1

(11) International Publication Number:

WO 96/280

(43) International Publication Date: 19 September 1996 (19.09.96)

(21) International Application Number:

PCT/AU96/00050

(22) International Filing Date:

1 February 1996 (01.02.96)

(30) Priority Data:

PN 1704

14 March 1995 (14.03.95)

AU

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(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, B  
CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, I  
JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MI  
MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SI  
SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN  
ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent  
(AZ, BY, KG, KZ, RU, TJ, TM), European patent (AT, BE  
CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT  
SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML  
MR, NE, SN, TD, TG).

Published

With international search report.

(54) Title: DISINFECTANT/INSECTICIDE COMPOSITION CONTAINING EUCALYPTUS OIL AND AUSTRALIAN TEA TREE OIL

(57) Abstract

A disinfecting and insecticidal composition comprising: (a) 5-25 % by volume a wetting agent/surfactant, (b) 10-40 % by volume an alcohol, (c) 0.25-14 % by volume a combination of Australian Tea Tree Oil (Melaleuca Oil) and Eucalyptus Oil, (d) water.

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Disinfectant/Insecticide composition containing Eucalyptus oil and Australian Tea Tree Oil

The present invention relates to a disinfecting and insecticidal composition, and in particular, but not exclusively, to a disinfecting and insecticidal composition which is manufactured from natural chemical products.

5

Up to the present time it has been necessary when requiring to disinfect a surface or object, and also to prevent insect infestation on or adjacent to that surface or object, to provide the surface or object with two separate treatments. That is, it has been necessary to firstly treat with a broad spectrum disinfecting agent and then secondly to  
10 apply a surface treating insecticidal or insect repelling agent. Applying two separate treatments in order to carry out the requirement of insect prevention and disinfection is both time consuming and tedious, and it would therefore be desirable to develop a composition which exhibits activity as not only a broad spectrum disinfecting agent but also an insecticidal or insect repelling agent. It is given this background that the present  
15 invention has been conceived.

It is also to be recognised that in the present day and age the general public have become far more concerned about the types of chemical products which they utilise in their everyday lives. The reason for this is, firstly, the greater awareness about health  
20 issues and potential toxicities of chemical products and, secondly, the increased awareness about potential damage to our environment which can result from the use of chemical compositions. It is therefore desirable to develop chemical compositions which are not only effective, but also safe from a personal health point of view and also from a broader environmental perspective. It is generally considered advantageous therefore that where  
25 possible we should utilise natural chemical products which are generally lower in toxicity and are associated with fewer adverse environmental effects compared to synthetic compounds.

Moreover, there are also problems associated with the use of disinfecting agents  
30 known to date. The most commonly used disinfecting agent is benzalkonium chloride, and it is feared that because of the extensive use of this compound, that various strains of bacteria have developed resistance. This is especially dangerous as it would be expected that after treating with a disinfectant that the object or surface which has been

treated would be substantially free of bacterial or fungal growth, however this may not in fact be the case and could lead to the transmission of infection, especially where the disinfection is taking place in hospitals or food preparation areas.

5 It has also become apparent that benzalkonium chloride is not effective at killing *Staphylococcus* bacteria which is a strain of bacteria which can cause particularly dangerous infections. It is therefore desirable to develop a disinfecting agent which is an effective broad spectrum disinfectant which will have activity over a broad range of bacteria and fungi.

10

Accordingly, it is an object of the present invention to provide a composition which exhibits the dual activity of being a broad spectrum disinfectant and an insecticidal/insect repelling agent, at the same time as being comprised of at least substantially natural products which are essentially non toxic to humans and also generally  
15 environmentally friendly. It is a further object of the present invention to provide such a disinfecting and insecticidal composition which will be straightforward and economical to produce.

Other objects of the present invention will become apparent from the following  
20 description thereof.

According to one embodiment of the present invention there is provided a disinfecting and insecticidal composition which is comprised of:

- 25 (a) between 5% and 25% by volume of the total composition of a wetting agent;  
(b) between 10% and 40% by volume of the total composition of an alcohol;  
(c) between 0.25% and 14% by volume of the total composition of a combination of tea tree oil and/or eucalyptus oil; and  
(d) water.

30

According to a preferred embodiment of the invention, the alcohol is ethanol and the wetting agent is comprised of a mixture of sulphonic acid and caustic soda.

According to another embodiment of the invention, there is provided a method of manufacturing a disinfecting and insecticidal composition as described above which comprises the steps of:

- 5 (a) diluting a wetting agent with water and then
- (b) adding an alcohol, then
- (c) adding eucalyptus oil, then
- (d) adding tea tree oil and mixing the composition to homogeneity.

- 10 Preferably, the method referred to above will also comprise the initial step of preparing the wetting agent by mixing sulphonic acid and caustic soda.

According to a still further embodiment of the invention, there are provided methods of repelling insects, killing insects and disinfecting objects or surfaces by  
15 applying an amount of the composition referred to above to the said object or surface.

The present invention will now be fully described by way of example only.

It has surprisingly been shown that a composition containing a wetting agent, an  
20 alcohol and an amount of tea tree oil and/or eucalyptus oil with water is especially effective as a broad spectrum disinfecting agent, and also shows powerful activity as an insecticide and/or insect repelling agent. This composition is especially suited for large scale commercial applications such as disinfection and insecticide/insect repellent treatment of food preparation areas such as food processing plants or restaurant kitchens  
25 and also in hospitals, but naturally the applications of this composition are far broader and it can be usefully employed as a domestic cleaning agent and direct insecticide or surface applied insecticide.

Preferably, the composition includes between about 5% and about 25% by volume  
30 of the total composition of a wetting agent, between about 10% and about 40% by volume of the total composition of an alcohol, between about 0.25% and about 14% by volume of the total composition of a combination of tea tree oil and/or eucalyptus oil, with the balance of the composition being made up of water. The concentration ranges

of the components of the composition are determined by the activity of the component and its relative miscibility. For example, it has been shown that a total concentration of 0.25% by volume of the total composition of tea tree oil and/or eucalyptus oil is necessary for the composition to function as an effective antibacterial agent. Whereas,  
5 a concentration in excess of about 14% by volume of the total composition of tea tree and/or eucalyptus oil in combination will result in an immiscible mixture rather than a homogenous solution. Similarly, it is necessary to have an amount of at least about 10% by volume of the total composition of an alcohol in order for the composition to exhibit suitable activity as a disinfecting agent, but should the composition of alcohol be raised  
10 significantly above about 40% by volume of the total composition, there will again be a solubility problem.

The presence of a wetting agent of between about 5% and about 25% by volume of the total composition is necessary for solubility purposes. By the term "wetting agent"  
15 what is meant is the use of an agent which will act as a surfactant to reduce surface tension of the components of the composition such that the various components of the composition, some of which are immiscible, will be able to mix to form a homogenous solution. This homogeneity is important for the activity of the composition so that when it is applied as a disinfectant/insecticide, the active ingredients will be equally distributed  
20 upon the surface or object which is being treated. It is possible to utilise any known wetting agent such as wetting agents which are manufactured from a detergent base, however, the most preferred wetting agent is comprised of a mixture of caustic soda and sulphonic acid, and more specifically a mixture of caustic soda and alkylbenzene sulphonic acid.

25

The alcohol utilised in the composition can be any common alcohol, such as for example an alcohol of a  $C_1$ - $C_8$  hydrocarbon. This is mentioned by way of example only however and it is to be recognised that a broad range of alcohols will be acceptable in carrying out the present invention. It is expected however, that the most preferable  
30 alcohol will be ethanol due to its availability. One preferred source of ethanol which is readily available as a by-product, is by fermentation from sugar cane. Other sources of ethanol, are however equally acceptable.

It will be recognised that the alcohol component of the composition acts to improve its disinfecting activity, but at the same time also aids drying of the composition. This is useful where, for example, the composition is used to disinfect and insect treat a tiled floor, such that the composition will readily evaporate from the floor so that the floor will not remain wet for long periods of time, which could constitute an occupational health and safety hazard.

The key active ingredients in the composition of the present invention are tea tree oil and eucalyptus oil, and these ingredients in combination should be present in the concentration range of between about 0.25% and about 14% by volume of the total composition. While the ratio of these two components can be varied within the ranges of the combination which have been referred to above, it is apparent that improved disinfecting and insecticidal activity is obtained when both tea tree oil and eucalyptus oil are present. It appears, in fact, that these two plant essential oils when utilised together have a synergistic activity as disinfecting and insecticidal/insect repelling agents. The activity of the composition as a disinfecting and insecticidal composition is significantly increased when both the tea tree and eucalyptus oils are present. The preferred concentration of tea tree oil and eucalyptus oil is in the range of about 3% to about 7% by volume of the total composition and most preferably about 5% of each of these two oils.

Another aspect of this invention relates to the preparation of the inventive composition. As a result of the miscibility problems which are associated with the composition, it appears to be quite important as to the order in which the various components of the composition are added during the manufacture process. It has been found that the most preferred method of manufacture is to firstly dilute the wetting agent with the required amount of water and to then add in sequence the alcohol, the eucalyptus oil and finally the tea tree oil. The last stage of the process is to mix the components to a homogenous solution.

In the most preferred form of the invention the wetting agent is made of a mixture of caustic soda and alkylbenzene sulphonic acid, and the alcohol is ethanol. It is to be recognised that it is also possible to form a solid by adsorbing the solution onto a filler

block or a powder such as soda ash (by methods well known in the art). It is also possible to mix the composition with a propellant, as is well established and known in the art, in order to provide a sprayable aerosol composition which is useful for both direct killing of insects and insect repellent treatment of surfaces and/or insect repellent of humans or animals, or indeed for use as a disinfectant.

If being utilised as a personal insect repellent for humans or animals it is possible to have the product formulated as an aerosol spray as referred to above or indeed as a gel or cream when associated with customary pharmaceutical excipients, or in fact it is even possible to simply apply the composition in its natural state by rubbing it on the skin, hair or clothes of a human or animal, or possibly applying it using a roll-on applicator. It is to be recognised that other standard application techniques which are known in the personal insecticide art are also envisaged as being potential application techniques in relation to the present invention.

15

The composition according to the present invention is particularly suited to use as a general multi-purpose type disinfectant/insecticide for a broad range of applications. In particular it is envisaged that the composition will be especially useful for applications to walls and floors of areas which must be kept hygienically clean, for example in food preparation areas and in hospitals. The broad range of disinfecting action of this composition and its dual activity as an insecticide/insecticide repellent make it especially useful in these applications. The application of the composition for these purposes can be by any conventional method such as, for example, mopping, spraying or the use of a roller squeegee-type apparatus. It is also possible that the composition can be diluted further with water in order to be applied using a mop in convention cleaning practices. It is to be recognised however that further diluting the composition will affect its anti-bacterial, anti-fungal and insecticide activities.

The composition according to the present invention has been shown to exhibit insecticidal and insect repellent properties in relation to a broad range of insects. In particular the composition has been shown to be especially active for killing and repelling cockroaches, ants, flies, mosquitoes, beetles, spiders, silver fish, moths as well as numerous other insect species.



It is to be recognised that the present invention has been described by way of example only and that modifications and/or alterations which will be known to persons skilled in the art can be made thereto, without departing from the intended scope or spirit of the invention.

5

The invention will now be further described by way of the following examples:

Example 1

Formulation of preferred disinfectant/insecticide composition.

12.5% wetting agent comprising alkylbenzene sulphonic acid and

5 caustic soda

52.5% water,

30% ethanol

2.5% tea tree oil

10 2.5% eucalyptis oil

The composition percentages referred to above are percentages of each component by volume relative to the total volume of composition.

Example 2

15 A disinfectant/insecticide composition which was manufactured according to the formulation provided in Example 1 was applied using a mop and undiluted to a restaurant kitchen at the close of the restaurant for the evening. Prior to the treatment the restaurant had been reporting problems with cockroaches. Upon returning in the morning there were numerous dead cockroaches to be observed on the restaurant floor, and no live  
20 cockroaches could be found.

Example 3

A small test was carried out using the composition as formulated according to Example 1. The composition was applied to the concrete floor of a factory which was  
25 affected by an ant infestation. The composition was applied on areas of the floor where ants were travelling in a trail. It was observed that the ants would not travel over the concrete which had been treated using the composition, and instead they preferred to detour around the treated area. Any ants which were contacted with the composition were killed.

30

Example 4

A composition of the formulation of Example 1 was diluted 20:1 with water and then poured into an ants nest on an oval. Ants were observed to be killed directly and

inspection after 2 days revealed that no live ants were present in the nest.

Example 5

The formulation of Example 1 was sprayed on and adjacent to waste bins, behind  
5 a restaurant, where there had been a cockroach problem. The bins were sprayed four  
afternoons in a row, and then in the evening after the close of the restaurant the lights  
were switched off and the bin area was inspected using torches. No cockroaches could  
be observed, and there is no longer a cockroach infestation in the bin area.

The Claims defining the invention are as follows:

1. A disinfecting and insecticidal composition which is comprised of:
  - (a) between 5% and 25% by volume of the total composition of a wetting agent;
  - (b) between 10% and 40% by volume of the total composition of an alcohol;
  - (c) between 0.25% and 14% by volume of the total composition of a combination of tea tree oil and eucalyptus oil; and
  - (d) water.
2. The disinfecting and insecticidal composition of claim 1 wherein said wetting agent is present in an amount of between about 10% and about 15% by volume of the total composition, said alcohol is present in an amount of between about 25% and about 35% by volume of the total composition and said tea tree oil and said eucalyptus oil are each present in an amount of between about 3% and about 7% by volume of the total composition.
3. The disinfecting and insecticidal composition of either claim 1 or claim 2 wherein the alcohol is ethanol.
4. The disinfecting and insecticidal composition of any one of claims 1 to 3 wherein the wetting agent is comprised of a mixture of sulphonic acid and caustic soda.
5. The disinfecting and insecticidal composition of any one of claims 1 to 4 which is in a solid form.
6. A method of manufacturing a disinfecting and insecticidal composition according to claim 1 which comprises the steps of:
  - (a) diluting a wetting agent with water and then
  - (b) adding an alcohol, then
  - (c) adding eucalyptus oil, then
  - (d) adding tea tree oil and mixing the composition to homogeneity.

7. The method of claim 6 which further comprises the initial step of preparing the wetting agent by mixing sulphonic acid and caustic soda.
8. The method of either claims 6 or 7 wherein the alcohol is ethanol.
9. The method of any one of claims 6 to 8 comprising the additional step of adsorbing the composition onto a filler block or powder to form a solid.
10. The method of any one of claims 6 to 8 which comprises the additional step of mixing the composition with a propellant in order to form a sprayable aerosol.
11. A method of repelling insects from an object or surface which comprises the step of contacting the object or surface with an amount of the composition according to claim 1.
12. A method of repelling insects from a human or animal which comprises the step of applying an amount of the composition according to claim 1 to the skin or, hair or clothes of the human or animal in order to keep insects away.
13. A method of killing insects which comprises applying a composition according to claim 1 to a surface upon which insects will contact, or directly spraying or applying the composition on or adjacent to insects to be killed.
14. A method of disinfecting an object or surface which comprises applying an amount of a composition according to claim 1 to said object or surface.

15. A method of simultaneously disinfecting an object or surface and protecting the object or surface from insect infestation by applying an amount of a composition according to claim 1 to said object or surface.

# INTERNATIONAL SEARCH REPORT

International Application No.  
PCT/AU 96/00050

## A. CLASSIFICATION OF SUBJECT MATTER

Int Cl<sup>B</sup>: A01N 65/00; A61K 35/78; A61L 15/34

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC : A01N 65/00; A61K 35/78; A61L 15/35

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
AU : IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
Derwent and CAS  
(tea tree oil, Melaleuca Oil, Eucalyptus Oil, Cineole, Eucalyptol) and (biocide, disinfectant, antibacterial, antiseptic, antimicrobial, insecticide, pesticide)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X X X	AU, A, 37235/89 (OMARYNE PTY. LTD.) 4 January 1990 Page 4 lines 1-8 and lines 28-35 Page 5 lines 15-35 Claim 1	1, 2, 5, 6, 11-15 1, 2, 5, 6, 11-15 1, 2, 5, 6, 11-15

☒ Further documents are listed in the continuation of Box C

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Date of the actual completion of the international search  
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International Application No.

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C (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
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Y	Column 2 lines 29-37	1-3, 11-15
Y	Column 2 line 64 - Column 3 line 2	1-3, 11-15
Y	Column 3 lines 31-45	1-3, 11-15
Y	Column 4 line 64 Column 5 line 14	1-3, 11-15
Y	Column 5 lines 25-46	1-3, 11-15
Y	Column 6 lines 26-48	1-3, 11-15
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Y	Claims 1 and 7	1-3, 11-15
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Y	Planta medica Volume 26, 1974 D. Low, et. al. "Antibacterial action of the essential oils of some Australian myrtaceae with special references to the activity of chromatographic fractions of oil Eucalyptus citriodora." pages 184-189 Whole document	1, 2, 14
Y	Letters in applied Microbiology Volume 16, 1993 C.F. Carson and T.V. Riley "Antimicrobial activity of the essential oil of Melaleuca alternifolia" pages 49-55 Whole document	1, 2, 14



# INTERNATIONAL SEARCH REPORT

International Application No.  
PCT/ AU 96/00050

C (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	The medical Journal of Australia Volume 160, 21 February 1994 C.F. Carson and T.V. Riley "The antimicrobial activity of tea tree oil" page 236 Whole document	1, 2, 14
Y	The Australian Journal of Experimental Biology and Medical Science Volume 33, 1955 N. Atkinson and H.E. Brice "Antibacterial substances produced by flowering plants" pages 547-554 Whole document, esp. page 550	1, 2, 14
P, Y	Journal of Applied Bacteriology Volume 78, No. 3, 1995 C.F. Carson and T.V. Riley "Antimicrobial activity of the major components of the essential oil of <i>Malaleuca alternifolia</i> " pages 264-269 Whole document	1, 2, 14
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**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International Application No.  
**PCT/AU 96/00050**

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